

Clinical Animal Behaviour Models of Stereotypic Behaviour and Underlying Cognition



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Overview

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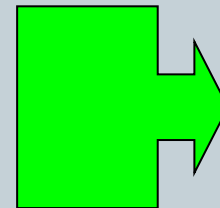
- What is stereotypic behaviour?
 - Phenotypic variability
 - Stereotypy and Obsessive Compulsive behaviour
- Heterogeneity of gross phenotypes
 - Mechanistic and Causal
- From laboratory to the field
 - *Ex laboratio* animal models of natural occurring human mental illness

Some differentials for tail chasing



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- Middle ear inflammation
- Pain – musculoskeletal or neurological
 - Tail
 - Back
 - Hind quarters
- Irritation in the tail region
 - Skin
 - Anal sacs
- Seizure
 - Primary neurological
 - Metabolic
- Play
- Attention seeking behaviour
- Acute motivational conflict
- “Compulsive-type” disorder
- Stereotypy



Stereotypic behaviour

Stereotypic behaviour

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- Repetitive, relatively invariable behaviour in which the function is not obvious from the form or context of the behaviour



Stereotypic behaviour is a gross phenotype requiring elaboration

Stereotypy versus Obsessive compulsive disorder



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- Stereotypy

“activities involving specific movements
(eg, rocking and hand flapping or waving)
or more broadly ... heterogeneous self-directed,
repetitive behaviors, activities, and interests
(eg, covering ears, staring at an object, pacing, object
fixation, playing in a fixed pattern, picking skin)

Singer 2009

Stereotypy versus Obsessive compulsive disorder



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- **Obsessive compulsive behaviour**

Obsessions as defined by (1), (2), (3), and (4):

1. Recurrent and persistent thoughts, impulses, or images that are experienced, at some time during the disturbance, as intrusive and inappropriate and that cause marked anxiety or distress
2. The thoughts, impulses, or images are not simply excessive worries about real-life problems
3. The person attempts to ignore or suppress such thoughts, impulses, or images, or to neutralize them with some other thought or action
4. The person recognizes that the obsessional thoughts, impulses, or images are a product of his or her own mind (not imposed from without as in thought insertion)

Compulsions as defined by (1) and (2):

1. Repetitive behaviors (e.g., hand washing, ordering, checking) or mental acts (e.g., praying, counting, repeating words silently) that the person feels driven to perform in response to an obsession, or according to rules that must be applied rigidly
2. The behaviors or mental acts are aimed at preventing or reducing distress or preventing some dreaded event or situation; however, these behaviors or mental acts either are not connected in a realistic way with what they are designed to neutralize or prevent or are clearly excessive

Mechanistic heterogeneity: A simple neurobiochemical reduction



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- **Obsessive- Compulsive Behaviours**
 - ✦ Failure to use knowledge to inhibit behaviour
 - Anxiety related disorders
- **Tics**
 - Tourette's Syndrome
- **Stereotypy**
 - ✦ Failure to inhibit the release of organised behavioural patterns
 - Schizophrenia
 - Autism
 - Tardive stereotypies
 - ✦ tardive dyskinesia/ t. chorea / dystonia / akathesia



Serotonin



Dopamine

Causal heterogeneity: A simple ontogenic reduction



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Frustration displacement



Seeking pleasure

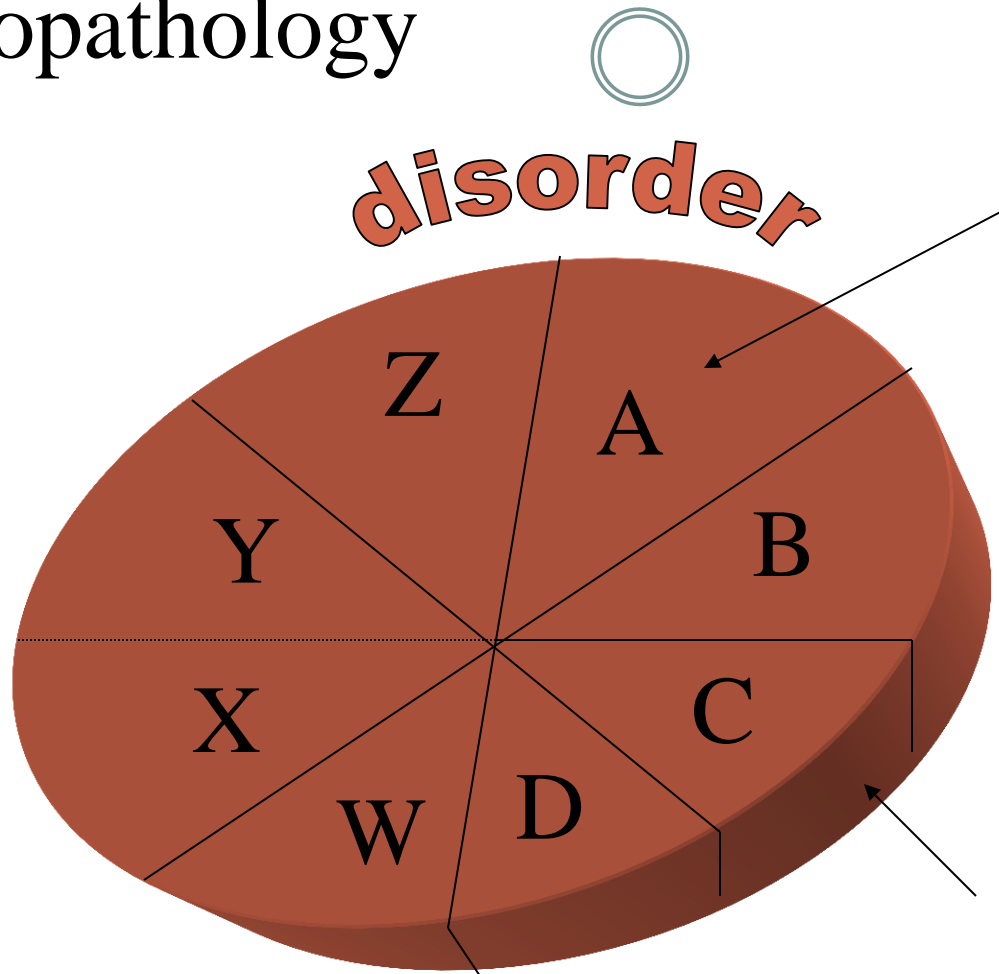


Two processes in classification



- Identification & labelling of collections of related characteristics
- Appropriate assignment of individuals
 - Diagnostic process
 - ✦ Diagnoses are rarely objectively verified in practice
 - ✦ Diagnoses are hypothetical constructs

The traditional view of psychopathology

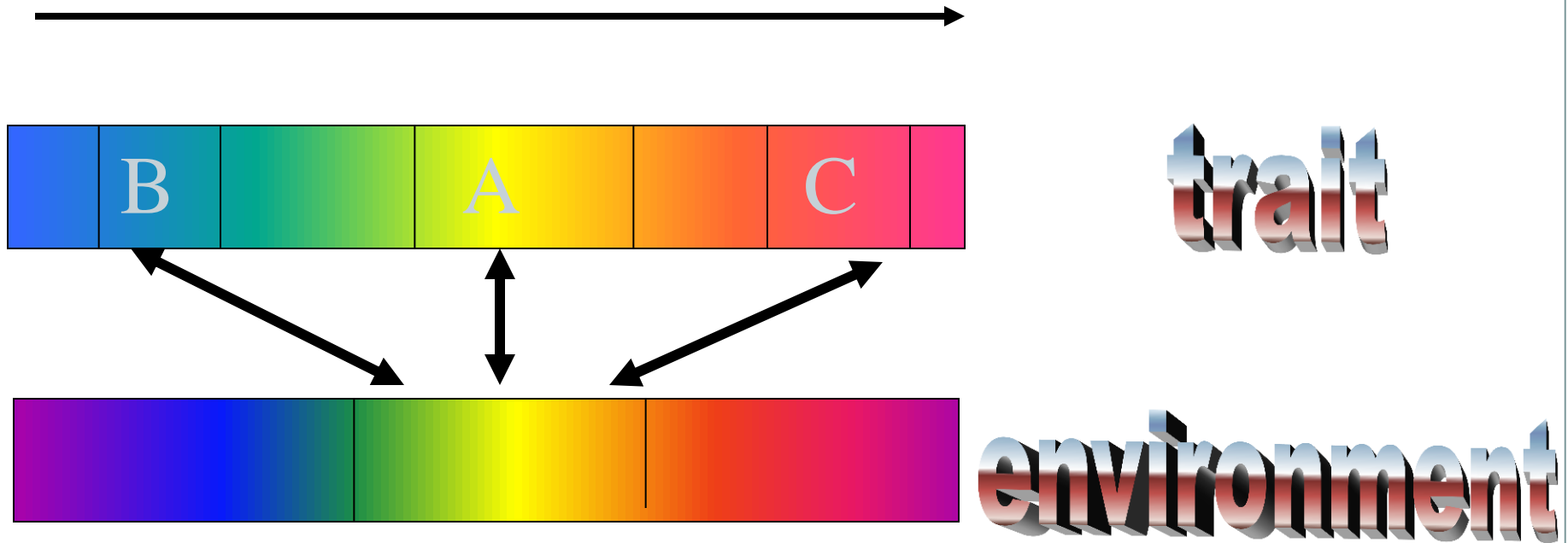


pathological
mechanism

pathological
mechanism



A spectral approach



Consequences



- In these circumstances, the behaviour problem is an emergent trait from the normal behaviour strategies of the individual. It is not a pathology
- If a normal system is overtaxed or exhausted then a genuine pathology may arise, this is often characterised by a disintegration of functional value

The nature of behaviour problems



- Most are combinations of behavioural responses and emotional states which have their origins in normality and are spectral in their form
- Thus mechanistic investigations may only identify normal mechanisms rather than the factors which make the behaviour inappropriate
- Need to frame behaviour problems in the context of key:
 - Behavioural
 - Affective
 - Cognitiveprocesses

An evolutionary / biological approach



- If behaviour appears inappropriate then investigate nature, source and degree of any suboptimality
- Distinguish those processes which are directly related to a definable organic lesion.
- Recognise the functional value at an evolutionary level of any psychological expressions even if they are not effective in a proximate sense
 - Triangulation of evidence to make rational inferences
 - Identification of biological markers

Repetitive behaviour in companion animals and human mental health disorders



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- ?potential for increased validity
 - Over-reduction of laboratory models
 - ✦ Pharmacological models
 - ✦ Genetic models
 - Companion animal models arise in similar contexts to humans through shared environment
 - ✦ Reflect true complexity of the phenotype
 - ✦ Wide range of conditions and differentials to consider
 - Analogies with human conditions often made on the basis of very superficial characteristics
 - ✦ Need to develop better clinical diagnostic process

Teasing out the neurological basis to stereotypic behaviour



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Biobehavioural markers

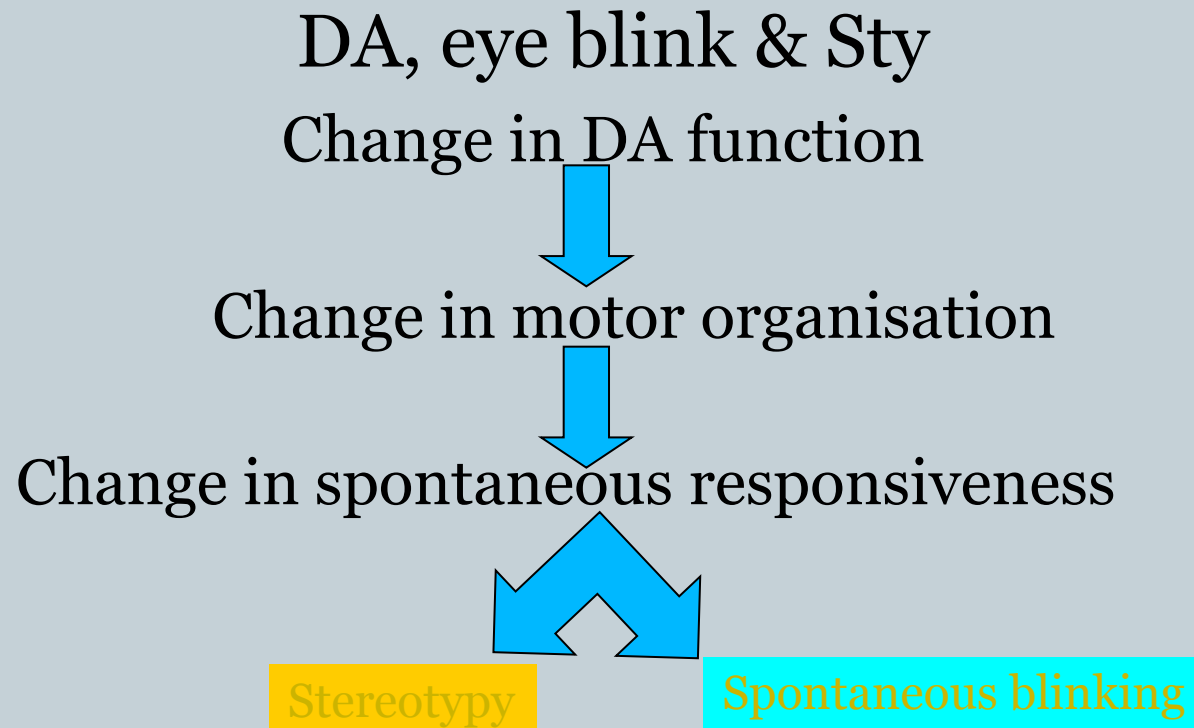
- Higher dopamine activity is correlated with higher rates of spontaneous eye blinks
- Increased dopamine activity in basal ganglia of schizophrenics
 - opposite in Parkinson's
- Eye blink frequency
 - Stereotypic schizophrenics – higher
 - Parkinson's - lower



Behavioural Correlates of Stereotypy

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- Basic behavioural correlates of neurological function



Assessment of blink rate in stereotypic horses



● Methodology

- 6 weavers
- 8 windsuckers and crib biters
- Paired height matched control no Sy
- No visual or ocular disease apparent
- Four x one-minute videos
- Light level assessed

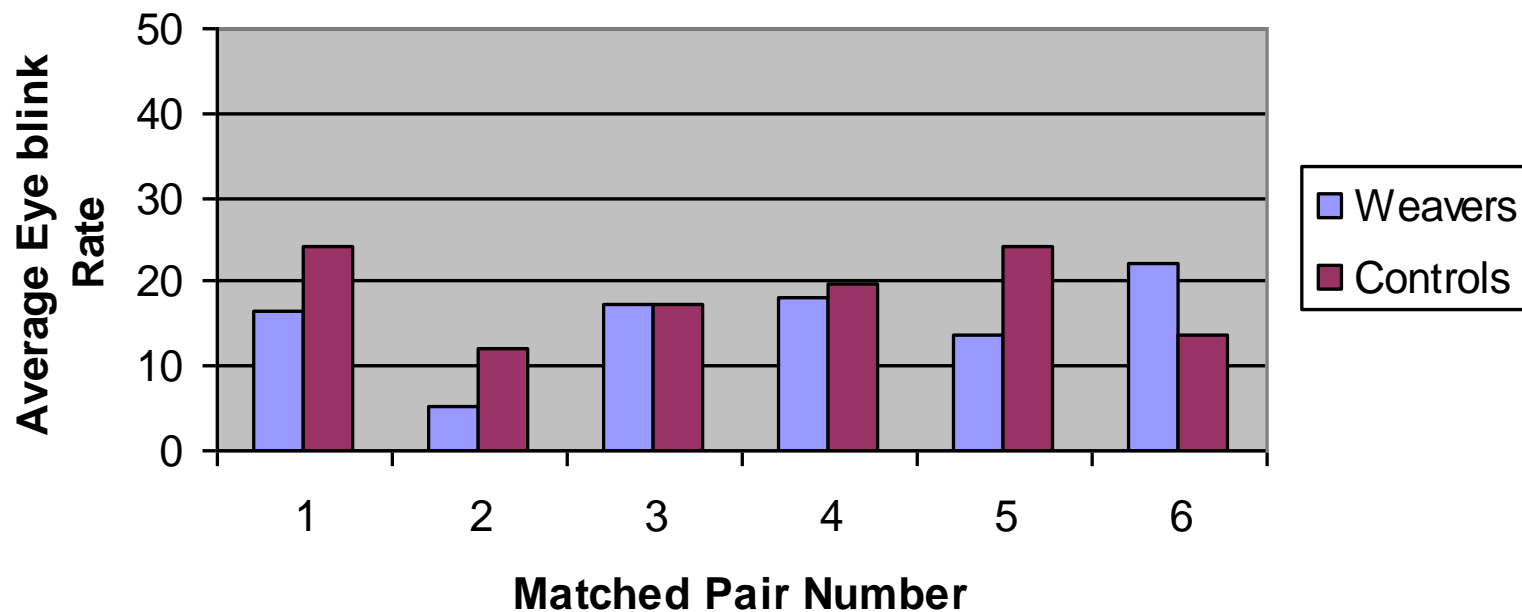


Results:

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Results of Blink Rate Data Comparing Weavers and Controls.



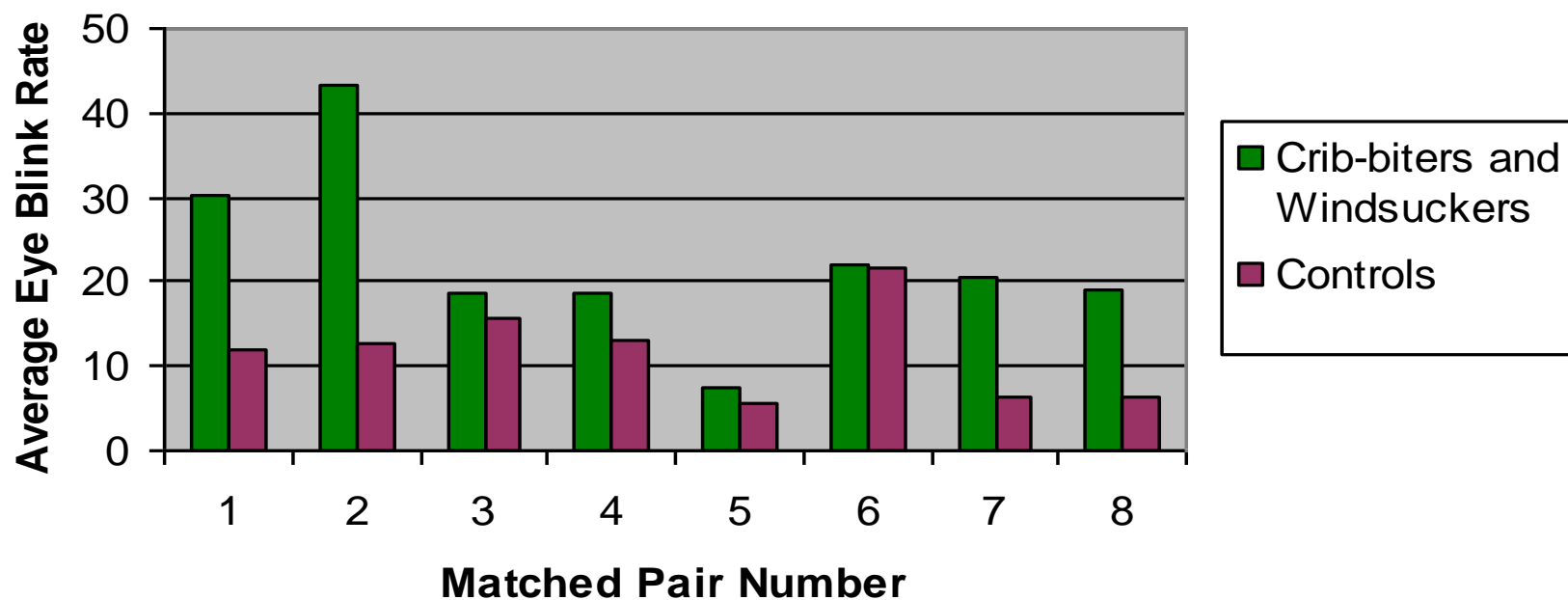
P= 0.33

Results:

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Results of Blink Rate Data Comparing Crib-Bitters/Windsuckers and Controls.



P=0.02

Variability in behaviour



	S.E.M	S.D
Weavers	2.34	5.74
Weaving Controls	2.08	5.1
Cribbers	3.71	10.5
Cribbing Controls	1.93	5.46

No significant difference between control populations.

Conclusions



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- Need to develop a biological framework to describe the differentials of stereotypic behaviour (and other problem behaviours) based on a recognition that
 - Maladaptive behaviour is not necessarily malfunction
 - ✦ consideration of cognitive and affective aspects of behaviour
 - Specific behaviours serve higher motivational-emotional systems
 - ✦ Behaviours are unlikely to be pathognomic for a given condition
- Use an evidence based approach to improve the assignment of individuals to these categories